

National Aeronautics and Space Administration

John C. Stennis Space Center Stennis Space Center, MS 39529-6000

COMPLIANCE IS MANDATORY

JOHN C. STENNIS SPACE CENTER FLUX CORED ARC WELDING OF CARBON STEEL (P-NO 1, GROUP 1 OR 2) FOR 1/8-INCH TO UNLIMITED PLATE THICKNESS

Original signed by

Scott Olive NASA SSC Center Operations Design & Construction Project Management Division	4-2-15 Date
M. F. Killam NASA SSC Center Operations Directorate Operations and Maintenance Division	4-6-15 Date
Bartt J. Hebert NASA SSC Engineering & Test Directorate	4-1-15 Date
Son Le NASA SSC Safety & Mission Assurance	4-2-15 Date
Issued by	
<u>Issued CEF</u> Central Engineering Files	4-7-15 Date

Stennis	SSTD-8070-0137-WELD Basic
Standard	Number Rev.
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Responsible Office: NASA SSC Center Operations Director	orate
SUBJECT: Flux Cored Arc Welding of Carbon Steel (F	P-No 1, Group 1 or 2) for 1/8-inch
to Unlimited Plate Thickness	·

Document History Log

Status/Change/ Revision	Change Date	Originator/Phone	Description
Basic	04.01.2015	Doug Dike x8-2803	Initial release. 1.0 and 2.0: Revised to reflect that this standard applies to structural use only. 3.0: Updated references to include AWS D1.1 and AWS 5.36.

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1.0 PURPOSE

This John C. Stennis Space Center (SSC) standard (SSTD) provides for a qualified American Society of Mechanical Engineers (ASME) and American Welding Society (AWS) weld procedure for Flux Cored Arc Welding (FCAW) of carbon steel; designated as P-No.1, Group 1 or 2 in ASME Boiler and Pressure Vessel Code, Section IX. This weld procedure is applicable to welding of carbon steel plate of 1/8-inch to unlimited thickness and pipe of nominal 24-inch diameter and larger with wall thickness of 1/8-inch and greater for structural use at SSC.

2.0 APPLICABILITY

- a. This SSTD applies to all contractor and subcontractor personnel involved with the FCAW welding of (P No. 1, Group 1 or 2) carbon steel plate and pipe for structural use at SSC.
- b. This SSTD is also valid for welding of (P No. 1, Group 1 or 2) carbon steel to (P No. 1, Group 1 or 2) carbon steel pipe, tube, fittings, or plate used in fluid services, provided that the produced welds are not fluid pressure boundary or pressure containing welds; e.g., carbon steel pipe supports or doubler plates welded to outer walls of carbon steel pipe and fittings being an allowed application of this standard.

3.0 REFERENCES AND APPLICABLE DOCUMENTS

Applicable documents shall be the latest version unless otherwise specified.

ASME Boiler and Pressure Vessel Code, Section II, Materials, Part A, Ferrous Material Specifications

ASME Boiler and Pressure Vessel Code, Section IX, Welding, Brazing, and Fusing Qualifications

AWS D1.1, Structural Welding Code - Steel

AWS 5.36, Specification for Carbon and Low-Alloy Steel Flux Cored Electrodes for Flux Cored Arc Welding and Metal Cored Electrodes for Gas Metal Arc Welding

SPR 1440.1, SSC Records Management Program Requirements

SPR 8715.1, SSC Safety and Health Program Requirements

SSTD-8070-0005-CONFIG, Preparation, Review, Approval and Release of SSC Standards

SSTD-8070-0013-WELD, Classes of Welding Inspection

SSTD-8070-0014-WELD, Qualifying Welders and Welding Procedures

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4.0 RESPONSIBILITIES

Responsibilities for the use and control of this SSTD and for the review and approval of revisions or cancellation of this SSTD shall be as specified in SSTD-8070-0005-CONFIG and the applicable documents referenced therein.

5.0 REQUIREMENTS AND PROCEDURES

- a. All procedures shall be performed in compliance with applicable requirements in SPR 8715.1. If ever there is a conflict between this SSTD and the SPR, the SPR takes precedence.
- b. Items denoted as essential variables in the attached weld procedure specifications (WPS) shall not be altered when using the WPS. An alternate WPS may be used only if approved prior to use by the NASA SSC Center Operations Directorate Project Management Division (PMD), the NASA SSC Engineering and Test Directorate (E&TD), and the NASA SSC Safety and Mission Assurance (S&MA) Office.
- c. The attached NASA-A36-FCAW(A) Procedure Qualification Record (PQR) is the PQR for the original WPSs in this SSTD. When performing new qualifications, a new, approved PQR shall be completed showing all pertinent data and results of the weld procedure qualification.
- d. Welders shall be qualified in accordance with SSTD-8070-0014-WELD.
- e. Inspection methods for welds shall be in accordance with SSTD-8070-0013-WELD.
- f. Qualification tests shall be performed on test coupons welded with backing plates.

6.0 RECORDS AND FORMS

- a. Records required by the procedures of this SSTD shall be maintained in accordance with SPR 1440.1 and as specified in this SSTD.
- b. All records and forms are the latest version unless otherwise indicated.
- c. The original, signed WPS and PQR (copies of which are provided in Attachments A of this SSTD) and the accompanying Certificate of Analysis validation test document shall be maintained in Central Engineering Files (CEF), together with the original, signed hardcopy of this SSTD.

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7.0 ACRONYMS AND ABBREVIATIONS

ASME American Society of Mechanical Engineers

AWS American Welding Society
CEF Central Engineering Files

E&TD Engineering and Test Directorate

FCAW Flux Cored Arc Welding

NASA National Aeronautics and Space Administration

PMD Project Management Division
PQR Procedure Qualification Record
PQRD Procedure Qualification Record Data

S&MA Safety and Mission Assurance

SPR John C. Stennis Space Center Procedural Requirement

SSC John C. Stennis Space Center

SSTD John C. Stennis Space Center Standard

WPS Weld Procedure Specifications

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ATTACHMENT A

A1: WPS NASA-A36-FCAW

FORM QW-482 SUGGESTED FORMAT FOR WELDING PROCEDURE SPECIFICATIONS (WPS) (See QW-200.1, Section IX, ASME Boiler and Pressure Vessel Code)

rganization Name	Jacobs Technology	By	L. deQuay				
Velding Procedure Specification No	NASA-A36-FCAW Date	2/25/15	Supporting PQR No.(s)	NASA-A36-FCAW (A)			
Revision No1	Date2/25/15						
Velding Processles)	FCAW	Type(s)	Semi-Automa	őc .			
		200-01-200-1-	(Automatic, Manual, Machine, or Semi-Auton				
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Nonmetallic Other							
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should show the general arrangement							
applicable, the details of weld groove	e may be specified.						
Sketches may be attached to illustrate							
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procedures, etc.)							
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(07/13)

^{*}Each base metal-filler metal combination should be recorded individually.

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SUBJECT: Flux Cored Arc Welding of Carbon Steel (P-No 1, Group 1 or 2) for 1/8-inch to Unlimited Plate Thickness

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Globular	Pulsing	Current										
Mode of Metal Transfer for GMAW (FCAW)	Tungste	n Electrode	Size and Typ	pe			(Pure Tur	astan 2% Thor	tated etc.)			
Spray Arc, Short Circuiting Arc, etc.] Other	Made	Matel Team	of an Int CM	NAV (EC AUA))								
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String or Weave Bead	Other	7				Power Sup	ply: CV (Constant	Votage)				
Orifice, Nozzle, or Gas Cup Size								B.ef	Janeary & SCI			
Initial and Interpass Cleaning (Brushing, Grinding, etc.) Method of Back Gouging	2-00							1, 3000				
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Peening									Single			
reening	A CONTRACTOR OF THE PARTY OF TH	e Spacing .	3						Aird allowed			
	Electrod								TYLE BELLWING			

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Stennis	SSTD-8070-0137-WELD	Basic
Standard	Number	Rev.
Standard	Effective Date: April 1, 201:	5
	Review Date: April 1, 202	0
	Pa	ge 9 of 12
Responsible Office: NASA SSC Center O	perations Directorate	
SUBJECT: Flux Cored Arc Welding of	Carbon Steel (P-No 1, Group 1 or 2) for 1	1/8-inch



to Unlimited Plate Thickness

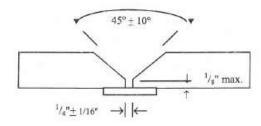
WPS# NASA-A36-FCAW ATTACHMENT # 1

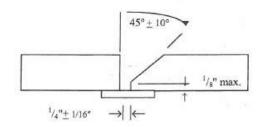
Note # 1 AWS D1.1

Any Group I to Any Group I Any Group II to Any Group I Any Group II to Any Group II

Joint Detail

Note: Maximum plate misalignment is ± 1/4"





Travis G Moore
CV// 99041251
QC1 EXP. 4/1/2014

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to Unlimited Plate Thickness	• • •

A2: PQR NASA-A36-FCAW(A)

FORM QW-483 SUGGESTED FORMAT FOR PROCEDURE QUALIFICATION RECORDS (PQR) (See QW-200.2, Section IX, ASME Boiler and Pressure Vessel Code) Record Actual Variables Used to Weld Test Coupon

	Jacobs Technology					
NASA-A36-FCAV		ate	Revised 2/25/	15		
NA:						
K	21.0/2007-0000	ni Automotic				
Senn-Automatic						
- C	150		-			
1/4"	- t- 1/8	5 1				
Groove Desig	n of Test Coupon					
posited weld metal th		Marine State of the State of th	E1	rocess used.)		
		T TREATMENT (QW-407)			
1985 o manos ca	100 Marie 1					
	Other					
(D)						
	GAS (QW-408)	Pe	rcent Composit	ion		
			100000000000000000000000000000000000000	Flow Rate		
	Observe	(Serversdown 6)	Maggratesperi	40CFH		
		Page 117 Charles	150.001.6079	40011		
2	3330 (333 ML)					
	F67777777775	Gan cup size - 34*		-		
	Other	- Contract of the				
	ELECTRICAL CU	ADACTEDICTICS	(0)4/ (00)			
			DCEP			
	100000000000000000000000000000000000000		Valte	24.5-30		
	The state of the s	via Siza	vuita			
			M/ECAM	Globular		
	V. Strong Strong Strong	ransier iur GIVIA	At (LCWAS)	200,000		
			tout Malterak			
	VWIE FEED	a speed - 100-2	/ J IFNI			
	TECHNIQUE (QW	V-410)				
	Travel Speed	nnieros (S. 1)		15 IPM		
N/A		Bead		imnger		
	Oscillation					
	Multipass or Sin	gle Pass (Per Si	16)	fultipless		
	Single or Multipl	le Electrodes	1000	Single		
			155 976 IF	26.4		
	vviie re	eeu Speeu -	100-Z/0 IF	1VI		
442" F max	Contac	t Tube to W	ork Distanc	e - %		
	Note: See attachment Groove Desig posited weld metal th serze ANY Group No.	NASA-A36-FCAW FCAW Ser Waser Note: See attachment for test recorded we Groove Design of Test Coupon posited weld metal thickness shall be rec POSTWELD HEA Temperature Time Other GAS (QW-408) Shielding Trailing Backing Other ELECTRICAL CHac Current Polarity Amps. Tungsten Electro Mode of Metal T Heat Input Other Power So Wire Feel TECHNIQUE (QM Travel Speed String or Weave Oscillation Multipass or Sin Single or Multip Other Wire Fell Wire Fell Wire Fell Ser ANA Ser ASS ANA TABLE TECHNIQUE (QM Travel Speed String or Weave Oscillation Multipass or Sin Single or Multip Other Wire Fell Wire Fell Technique (CM Travel Speed String or Weave Oscillation Multipass or Sin Single or Multip Other Wire Fell	NASA-A36-FCAW FCAW Semi-Automatic 150 Note: See attachment for test recorded weld passes. Groove Design of Test Coupon posited weld metal thickness shall be recorded for each fit POSTWELD HEAT TREATMENT (Temperature Time Other Gas(es) Shielding Augon (CO2 Trailling Backing Other ELECTRICAL CHARACTERISTICS Current Polarity Amps. Tungsten Electrode Size Mode of Metal Transfer for GMA Heat Input Other Power Source: CV (Cons Wire Feed speed - 155-2 TECHNIQUE (QW-410) Travel Speed String or Weave Bead Oscillation Multipass or Single Pass (Per Sin Single or Multiple Electrodes Other Wire Feed Speed	NASA-A36-FCAW FCAW Semi-Automatic Note: See attachment for test recorded weld passes. Groove Design of Test Coupon posited weld metal thickness shall be recorded for each filler metal and property of the		

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andard				Numbe			Rev
andard					April 1, 201:	5	
				Revi	ew Date:	April 1, 202	0
					Pag	ge 11 o	
esponsible Office	NASAS	SC Center	Operation	s Directorate			,
UBJECT: Flux							
	PROCED	URE QUALIFIC	ATION RECO	Kev	SA-A36-FCAW(A) rised 2/25/20		
Specimen	PROCED	URE QUALIFIC	TEST RES	ULTS Rev		Character	
Specimen No.	Width	Thickness	TEST RES	TEST Ultimate Tensile Load. lb	rised 2/25/20 Ultimate Unit Stress. psi	Character and Lo	cation
	Width 0.751"	Thickness 1.211"	TEST RES	TEST Ultimate Tensile Load. lb 71,028	Ultimate Unit Stress. psi 78,096	Character and Lo	cation se
No.	Width	Thickness	TEST RES	TEST Ultimate Tensile Load. lb	rised 2/25/20 Ultimate Unit Stress. psi	Character and Lo	cation se
No. 7319.90(.1) T-1 7319.90(.1) T-2 Specimen No.	Width 0.751" 0.752"	Thickness 1.211" 1.205"	TEST RESI TENSILE T Area 0.9095" 0.9062" GUIDED BEN Resul	TEST Ultimate Tensile Load. lb 71,028 70,835 D TEST	Ultimate Unit Stress. psi 78,096 78,167	Character and Lo	cation se
No. 7319.90(.1) T-1 7319.90(.1) T-2 Specimen No. 7319.90(.1)	Width 0.751" 0.752" Type o Side	Thickness 1.211" 1.205"	TEST RESI TENSILE T Area 0.9095" 0.9062" GUIDED BEN Resul Accepta	TEST Ultimate Tensile Load. lb 71,028 70,835 D TEST	Ultimate Unit Stress. psi 78,096 78,167	Character and Lo Bas	cation se
No. 7319.90(.1) T-1 7319.90(.1) T-2 Specimen No.	Width 0.751" 0.752"	Thickness 1.211" 1.205" of Bend Bend Bend	TEST RESI TENSILE T Area 0.9095" 0.9062" GUIDED BEN Resul	TEST Ultimate Tensile Load. lb 71,028 70,835 D TEST ble ble ble	Ultimate Unit Stress. psi 78,096 78,167	Character and Lo Bas	cation se

/319.90(.1)	Side Delia	2 teceptatore	_		
7319.90(.1)	Side Bend	Acceptable			
VISUAL INSPECTIO		Radiographic, RT Report No.	Magnetic & Visua 86835	l Examination Result Acceptal	alo.
Undercut None			THE RESERVE OF THE PARTY OF THE	Result Acceptal	
Piping Porosity None		MT Report No		Result Acceptat	
	ptable	VT Report No.	Annual Control of the	D TEST RESULTS	ме
Test Date					JP 2000
Witnessed By Travis G. Moore		Minimum size	multiple pass	Maximum size singl Macro-etch	e pass
		Macro-etch	2 31/4		NIZA
		1. N/A	3. N/A		N/A
		2. N/A	-	2. N/A	
Other Tests		All-Weld-Meta	I Tension Test		
		Tensile Strengt			
		Yield Point/Str			
		Elongation in 2	- AND DESCRIPTION OF THE PERSON NAMED IN COLUMN 1		
			tory Test No. N	/A	
		240014			
Welder's Name Cases	Deschamp	Soc. Sec. No. 2778		Stamp No. JT-43	
SECOND CONTRACTOR CONT		D: A			
Tests Conducted ByI	nspection Specialists, Inc MT	. Div.	Travis G Moore	*	
	Test Nur	iber 7319.90(.1)	CWI 99041251		
	= 0.0 T/A-5A77		QC1 EXP. 4/1/2	L.	***
		Per From	nue	Travis G Moore	8.0
			1.1.	I wolded and tested in so	anadanas mist
We, the undersigned, cert	ify that the statements in this reco	2010) Structural Wolding Co.	eras were prepared	i, weided, and tested in ac	cordance with
the requirements of Section	on 4, Part B of ANSI/AWS D1.1 (year	de-Steet.		
		···· - /			
	Signed	Jac 195			
	0	Manufacture	or Contractor		
	By So	A Med	16-		
	By	1 11-1-5			•
	Title	UNU - LUTT	/CWI	S	
	0.001090211	2 12 111	-		

Stennis
Standard

SSTD-8070-0137-WELD Basic

Number Rev.

Effective Date: April 1, 2015

Review Date: April 1, 2020

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Responsible Office: NASA SSC Center Operations Directorate

SUBJECT: Flux Cored Arc Welding of Carbon Steel (P-No 1, Group 1 or 2) for 1/8-inch to Unlimited Plate Thickness

A3: Certificate of Analysis

INSPECTION	SPECIALISTS, I	NC.						
		MECHANICAL TESTING LAB	ORATORY DIVISION					
	C	ERTIFIC	ATE O	F ANAI	YSIS			
Client: Jacobs	Technology			Job No	: _7319.90			
Client Represent	ative: Ben	ny McGrath		Purcha	se Order:			
Test Specification	n: AWS D1.	1						
Sample Identifica	E 5850	(1) 1.250" Plate	WPS # NAS	A-A36-FCAW	PQR#NASA-A36	-FCAW (A)		
	-	der: Casey Deschamp		JT-43"	ASTM A- 36			
the samples was x-	rayed. The resul	ts of these tests are re	ported herein. TENSILE TES	ST				
CONCURSED	WITNITT	TITICALNINGS	. 25.27 4	ULTIMATE	TENSILE	NATURE		
SPECIMEN ID	WIDTH	THICKNESS	AREA SO. IN.	LOAD POUNDS	STRENGTH PSI	OF FRACTURE		
7319.90(.1) 1-1	0.751"	1.211"	0.9095"	71,028	78,096	Base		
7319.90(.1) T-2	0.752"	1.205"	0.9062"	70,835	78,167	Base		
		6	UIDED BEND	TEST				
	IMEN ID		TYPE TEST		TEST RI	NO PERSONAL PROPERTY AND ADDRESS OF THE PERSONAL		
7319.90(.1) S1			Side Bend Side Bend		Accept			
7319.90(.1) S2 7319.90(.1) S3			Side Bend			Acceptable Acceptable		
7319.90(.1) 84			Side Bend		Accept			
		N: Acceptable (Repo cceptable (Report #1						
		table (Report # 12998)						
		4						
he tests expressed	herein meet or e	exceed the requiremen	nts of AWS D1.1					
CERTIFIED BY	Travis G CWI 99 QC1 EX	041251 P, 4/1/2014						
Iren 1	+ Much	/ D	ate: February	3, 2014	Certificate No:	1 of 1		
ravis G. Moore, L.	4 16							